

CLAIMS

What is claimed is:

1. A magnetizable composition comprising an admixture of thermoplastic polymer, elastomeric polymer, and magnetizable powder.
2. A magnetizable composition according to Claim 1 wherein said thermoplastic polymer provides a first phase in said composition, said elastomeric polymer provides a second phase in said composition, and said magnetizable powder is dispersed in said first phase and in said second phase.
3. A composition according to Claim 1, wherein said elastomeric polymer is fully cured.
4. A composition according to Claim 1, wherein said elastomeric polymer is partially cured.
5. A magnetizable thermoplastic elastomer composition according to Claim 1 wherein said thermoplastic polymer is thermoplastic elastomer and said elastomeric polymer is thermoset elastomer.
6. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the thermoset elastomer is an elastomer that has not been subjected to vulcanization.

7. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the thermoset elastomer is selected from the group consisting of ethylene acrylic elastomers, acrylate elastomers, cross-linking monomer elastomers, and mixtures thereof.

8. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the thermoplastic elastomer is from about 5% to about 50% (by weight) of the composition.

9. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the thermoset elastomer is from about 3% to about 40% (by weight) of the composition.

10. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the magnetizable powder is from about 1% to about 90% (by weight) of the composition.

11. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the magnetizable powder is selected from the group consisting of strontium ferrite oxide, barium ferrite oxide, ferrite alloys containing aluminum and nickel and cobalt, rare-earth ferrites, and mixtures thereof.

12. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein the thermoplastic elastomer is thermoplastic polyester elastomer.

13. A magnetizable thermoplastic elastomer composition according to Claim 5 wherein said thermoplastic elastomer provides a first phase in said composition, said thermoset elastomer provides a second phase in said composition, and said magnetizable powder is dispersed in said first phase and in said second phase.

14. A magnetizable thermoplastic elastomer composition according to Claim 9, wherein said thermoset elastomer is fully cured.

15. A magnetizable thermoplastic elastomer composition according to Claim 9, wherein the said thermoset elastomer is partially cured.

16. A target wheel for use in an encoder comprising a generally disk shaped member made of a thermoplastic elastomer admixture of thermoplastic elastomer, thermoset elastomer, and magnetizable powder.

17. The target wheel according to Claim 16 wherein the thermoplastic elastomer is thermoplastic polyester elastomer.

18. The target wheel according to Claim 16 wherein the thermoset elastomer is selected from the group consisting of ethylene acrylic elastomers, acrylate elastomers, cross-linking monomer elastomers, and mixtures thereof.

19. The target wheel according to Claim 16 wherein the magnetizable powder is selected from the group consisting of strontium ferrite oxide, barium ferrite oxide, ferrite alloys containing aluminum and nickel and cobalt, rare-earth ferrites, and mixtures thereof.

20. The target wheel according to Claim 16 wherein said thermoplastic elastomer provides a first phase in said target wheel, said thermoset elastomer provides a second phase in said target wheel, and said magnetizable powder is dispersed in said first phase and in said second phase.

21. The target wheel according to Claim 16, wherein said thermoset elastomer is fully cured.

22. The target wheel according to Claim 16, wherein the said thermoset elastomer is partially cured.

23. An encoder comprising:

- (a) a magnetic sensor adapted to detect changes in an adjacent magnetic field; and
- (b) a target wheel, according to Claim 16, having a surface adjacent the magnetic sensor and movable relative thereto, said target wheel made of a thermoplastic elastomer admixture of thermoplastic elastomer, thermoset elastomer, and magnetizable powder, said target wheel magnetized to provide alternating magnetic polarity along said surface and, in operation, said magnetic field changes thereby.

24. The encoder according to Claim 23 wherein the magnetic sensor is adapted for attachment to one of a wheel and a vehicle body in a vehicle, and the target wheel is adapted for attachment to the other of the wheel and the vehicle body.

25. The encoder according to Claim 23 wherein said thermoplastic elastomer provides a first phase in said target wheel, said thermoset elastomer provides a second phase in said target wheel, and said magnetizable powder is dispersed in said first phase and in said second phase.

26. A method of making a target wheel for a rotational encoder, comprising:

- (a) admixing thermoplastic elastomer, thermoset elastomer, and magnetizable powder to form a thermoplastic elastomer admixture;
- (b) molding said admixture into a target wheel; and
- (c) magnetizing said target wheel to provide alternating magnetic polarity along a surface of said target wheel which in rotational operation will provide a changing magnetic field for sensing by a sensor.

27. The method according to Claim 26 further comprising (d) heat-aging said target wheel.

28. The method according to Claim 26 wherein said molding step is achieved with a compression-molding process.

29. The method according to Claim 26 wherein said molding step is achieved with an injection molding process.

30. The method according to Claim 26 wherein the thermoset elastomer is an elastomer that has not been subjected to vulcanization.

31. The method according to Claim 26 wherein the thermoset elastomer is selected from the group consisting of ethylene acrylic elastomers, acrylate elastomers, and cross-linking monomer elastomers.

32. The method according to Claim 26 wherein the thermoplastic elastomer is thermoplastic polyester elastomer.

33. The method according to Claim 32 wherein the thermoset elastomer is selected from the group consisting of ethylene acrylic elastomers, acrylate elastomers, and cross-linking monomer elastomers.

34. A method according to Claim 26, wherein said molding of said admixture comprises:

- (i) molding a thermoplastic as a structural substrate for said target wheel; and
- (ii) over-molding said admixture onto said structural substrate.

35. A magnetizable composition comprising:
  - (a) a first phase conveying a thermoplastic polymeric material;
  - (b) a second phase comprising cured elastomeric polymeric material; and
  - (c) magnetizable powder dispersed in said first phase and in said second phase.

36. A composition according to Claim 35, wherein said elastomeric polymeric material is fully cured.

37. A composition according to Claim 35, wherein said elastomeric polymeric material is partially cured.

38. A composition according to Claim 35, wherein said thermoplastic polymeric material comprises polyester thermoplastic elastomer.

39. A composition according to Claim 35, wherein said elastomeric polymeric material is selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof.

40. A composition according to Claim 35, wherein said thermoplastic polymeric material comprises polyester thermoplastic elastomer; said elastomeric polymeric material comprises a material selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof; and said hard magnetic material comprises from about 10% to about 90% (by volume) of said composition.

41. A composition according to Claim 40, wherein said hard magnetic material comprises from about 25% to about 70% (by volume) of said composition.

42. A composition according to Claim 40, wherein said elastomeric polymeric material is present at a level of from about 10% to about 300% (by weight) of said thermoplastic material.

43. A composition according to Claim 40, wherein said elastomeric polymeric material is present at a level of from about 10% to about 100% (by weight) of said thermoplastic material.

44. A composition according to Claim 40, wherein said elastomeric polymeric material is present at a level of from about 10% to about 100% (by weight) of said thermoplastic material.

45. A shaped article covering a magnetable composition according to Claim 35.

46. An encoder comprising:

(a) an encoder case; and

(b) a shaped article comprising an encoder elastomer adhered to said case;

wherein said encoder elastomer comprises a thermoplastic polymeric material first phase and a cured elastomeric polymeric material second phase, and magnetizable particles of hard magnetic material are dispersed in said first phase and in said second phase, and wherein said encoder elastomer comprises alternating opposite magnetic poles along a surface of said article.

47. A radial encoder according to Claim 46.

48. An axial encoder according to Claim 46.

49. An encoder according to Claim 46, wherein said elastomeric polymeric material is fully cured.

50. An encoder according to Claim 46, wherein said elastomeric polymeric material is partially cured.

51. An encoder according to Claim 46, wherein said thermoplastic polymeric material comprises polyester elastomer.

52. An encoder according to Claim 46, wherein said elastomeric polymeric material is selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof.

53. An encoder according to Claim 46, wherein said thermoplastic polymeric material comprises polyester elastomer; said elastomeric polymeric material comprises a material selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof; and said hard magnetic material comprises from about 10 percent to about 90 percent by volume of said encoder.

54. An encoder according to Claim 53 wherein said hard magnetic material comprises from about 25% to about 70% (by volume) of said encoder elastomer.

55. An encoder according to Claim 53, wherein said elastomeric polymeric material is present at a level of from about 10 percent to about 300 percent by weight of said thermoplastic material.

56. An encoder according to Claim 53, wherein said elastomeric polymeric material is present at a level of from about 10 percent to about 100 percent by weight of said thermoplastic material.

57. An encoder according to Claim 53, wherein said elastomeric polymeric material is present at a level of from about 10 percent to about 100 percent by weight of said thermoplastic material.

58. A seal assembly for a bearing comprising:

- (a) an encoder adapted to be affixed to a rotating member and comprising an encoder case and an encoder elastomer adhered to said case; and
- (b) a seal disposed in sealing contact with said encoder and adapted to be affixed to a stationary member;

wherein said encoder elastomer comprises:

- (1) a first phase comprising a thermoplastic polymeric material, and
- (2) a second phase comprising a cured elastomeric polymeric material,

wherein magnetizable particles of hard magnetic material are dispersed in said first phase and in said second phase.

59. A seal assembly according to Claim 58, wherein said elastomeric polymeric material is selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof.

60. A seal assembly according to Claim 58, wherein said thermoplastic polymeric material comprises polyester thermoplastic elastomer; said elastomeric polymeric material comprises a material selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof; and said hard magnetic material comprises from about 10 percent to about 90 percent by volume of said encoder elastomer.

61. A seal assembly according to Claim 59 wherein said hard magnetic material comprises from about 25% to about 70% (by volume) of said encoder elastomer.

62. A seal assembly according to Claim 59, wherein said elastomeric polymeric material is present at a level of from about 10 percent to about 300 percent by weight of said thermoplastic material.

63. A seal assembly according to Claim 58, wherein said encoder is a radial encoder.

64. A seal assembly according to Claim 58, wherein said encoder is an axial encoder.

65. A process for making a magnetizable polymer composition comprising:

- (a) dispersing hard magnetic material in a blend of a thermoplastic material and elastomeric material, wherein said elastomeric material is in an uncured state or a partially cured state; and
- (b) curing said elastomeric material in the presence of said thermoplastic material and said hard magnetic material.

66. A process according to Claim 65, wherein said dispersing further comprises:
  - (1) combining thermoplastic polymeric material, uncured elastomeric polymeric material, and particles of hard magnetic material to form a combination, wherein said hard magnetic material comprises from about 10 percent to about 90 percent by volume of said combination; and
  - (2) applying mechanical energy to said combination to form said blend; and wherein said curing further comprises continuing to apply mechanical energy during said curing.

67. A process according to Claim 65, further comprising dynamically vulcanizing said elastomeric material during said dispersing of said thermoplastic material and said hard magnetic material.

68. A process according to Claim 65, carried out in a twin-screw extrusion apparatus.

69. A process according to Claim 66, wherein said composition comprises from about 10 to about 300 parts of said elastomeric material per 100 parts of thermoplastic material.

70. A process according to Claim 69, wherein said thermoplastic material comprises thermoplastic elastomer.

71. A process according to Claim 69, wherein said elastomeric material is selected from the group consisting of acrylic elastomers, ethylene acrylic elastomers, and mixtures thereof.

72. A process according to Claim 70, wherein said composition comprises from about 10 to about 100 parts of said elastomeric material per 100 parts of thermoplastic material.

73. A process according to Claim 71, wherein said composition comprises from about 25 to about 100 parts of said elastomeric material per 100 parts of thermoplastic material.